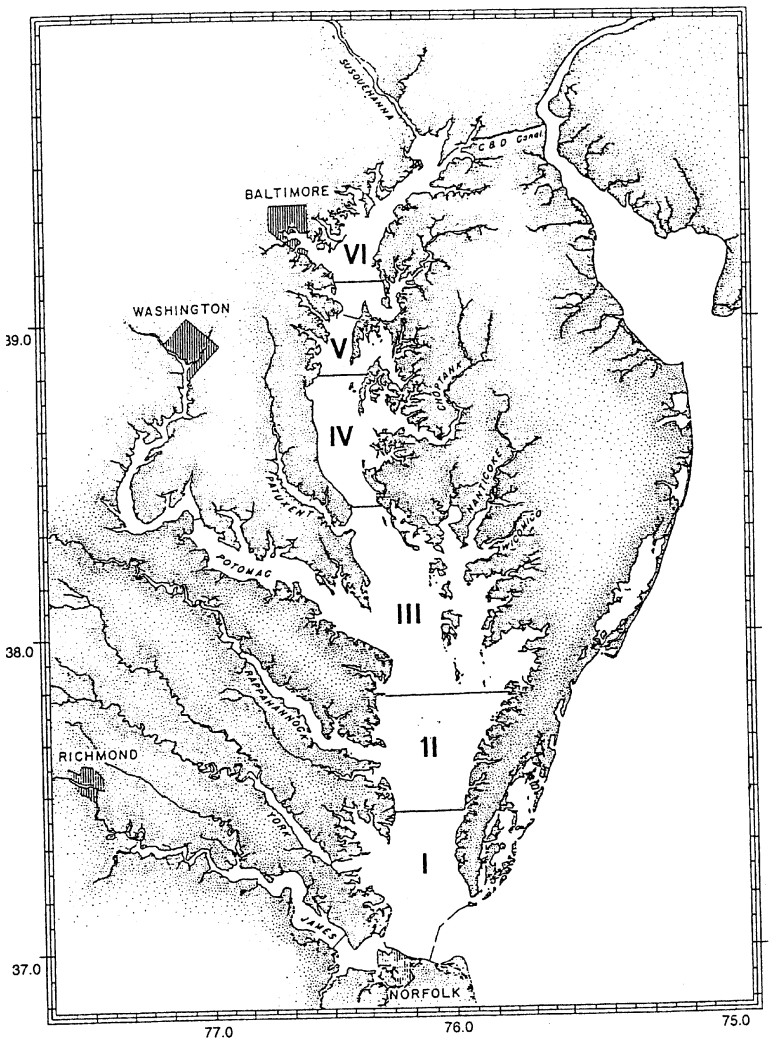
Chesapeake Bay
Harding and Perry



Chesapeake Bay showing locations of the 6 regions.

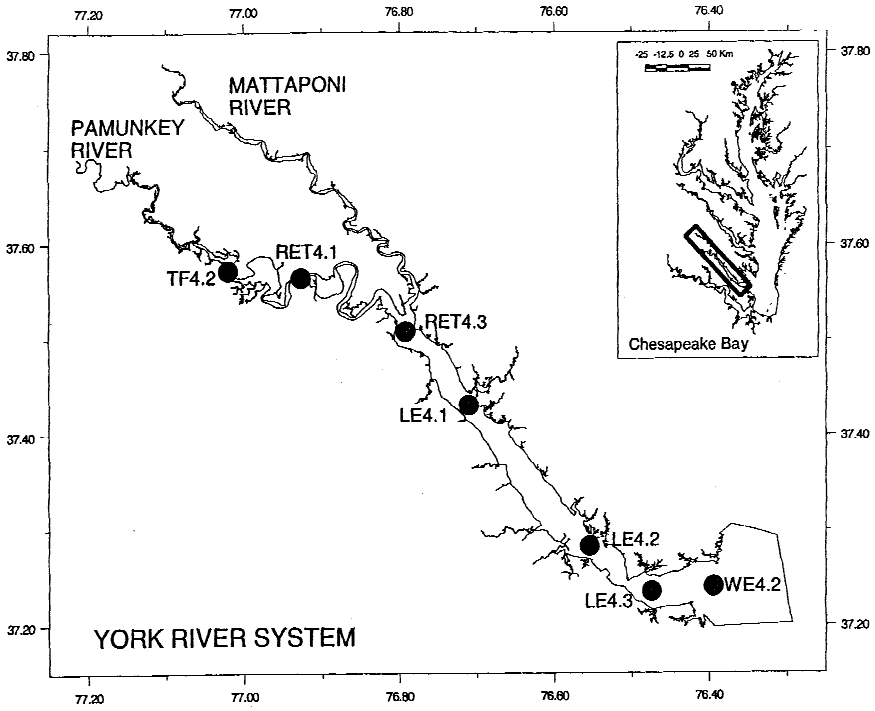
Regions in the Chesapeake Bay by latitude and geographic location.

Region	Latitude range	Geographic location
I	36.95-37.40°N	Mouth of Bay to Mobjack Bay
II	37.41-37.80°N	Mobjack Bay to Rappahannock River
III	37.81-38.40°N	Rappahannock River to Patuxent River
IV	38.41-38.80°N	Patuxent River to South River/Annapolis
V	38.81-39.10°N	South River/Annapolis to Bay Bridge/Magothy River
VI	39.11-39.66°N	Bay Bridge/Magothy River to Susquehanna Flats

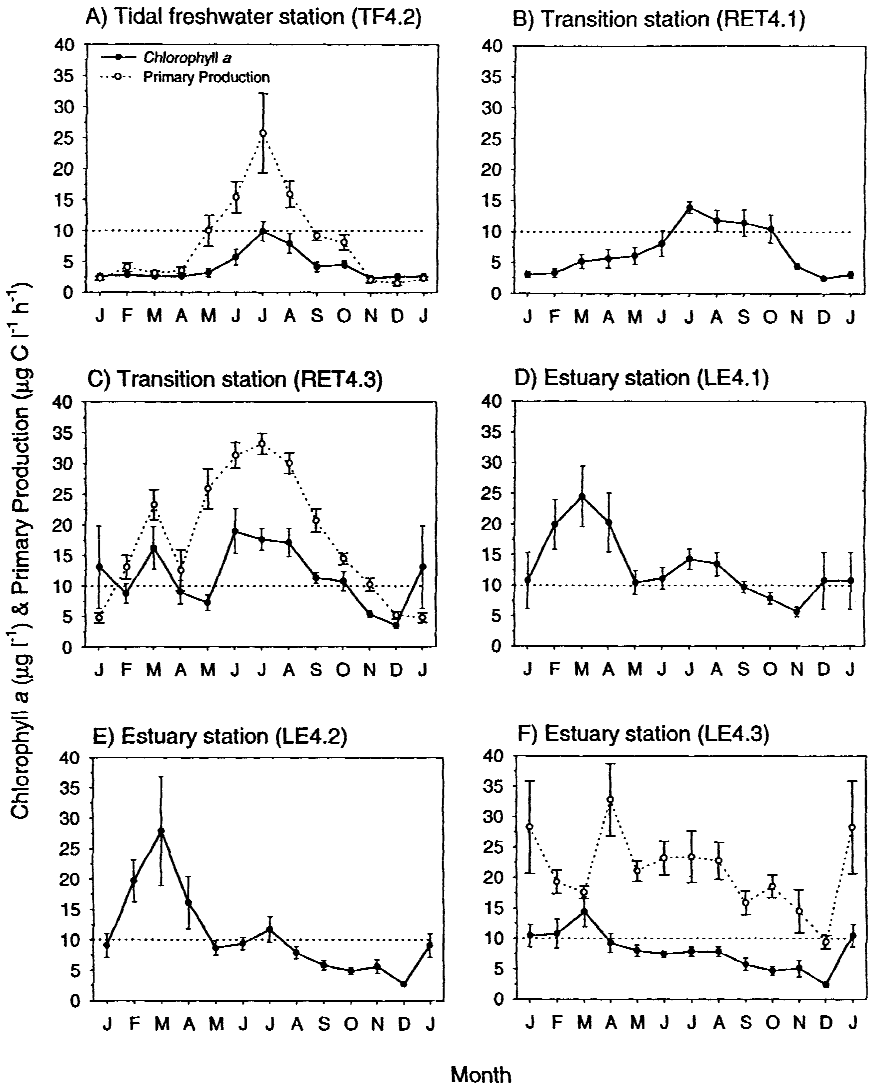
Year	Region	n	LS mean	95% LCI	95% UCI
1985	I	227	5.17	4.63	5.75
	II	254	5.77	5.22	6.38
	III	149	7.19	6.32	8.17
	IV	142	7.84	6.88	8.92
	V	124	10.5	9.17	12.0
	VI	106	7.17	6.15	8.34
1986	I	240	5.21	4.68	5.78
	II	243	6.79	6.13	7.50
	III	161	7.42	6.56	8.38
	IV	141	7.81	6.85	8.89
	V	143	10.6	9.39	12.1
	VI	118	6.74	5.82	7.78
1987	I	265	8.91	8.12	9.78
	II	249	10.6	9.61	11.6
	III	173	9.86	8.79	11.1
	IV	148	10.5	9.26	11.8
	V	159	12.1	10.8	13.7
	VI	128	7.60	6.62	8.71
1988	I	251	5.05	4.55	5.60
	II	241	8.78	7.95	9.67
	III	160	10.3	9.17	11.6
	IV	124	8.42	7.33	9.66
	V	126	10.9	9.53	12.4
	VI	109	6.04	5.18	7.03
1989	I	243	5.98	5.40	6.62
	II	234	7.51	7.08	7.95
	III	252	8.39	7.62	9.23
	IV	116	8.93	7.74	10.3
	V	230	10.9	9.85	12.0
	VI	223	5.69	5.10	6.33
1990	I	218	6.31	5.67	7.02
	II	234	10.4	9.41	11.4
	III	130	9.90	8.66	11.3
	IV	129	9.49	8.30	10.8
	V	146	10.8	9.53	12.2
	VI	118	4.76	4.08	5.54

Summary statistics on surface chlorophyll concentrations (mg m^{-3}) from Monitoring Program cruises on the Chesapeake Bay, 1985-1990.

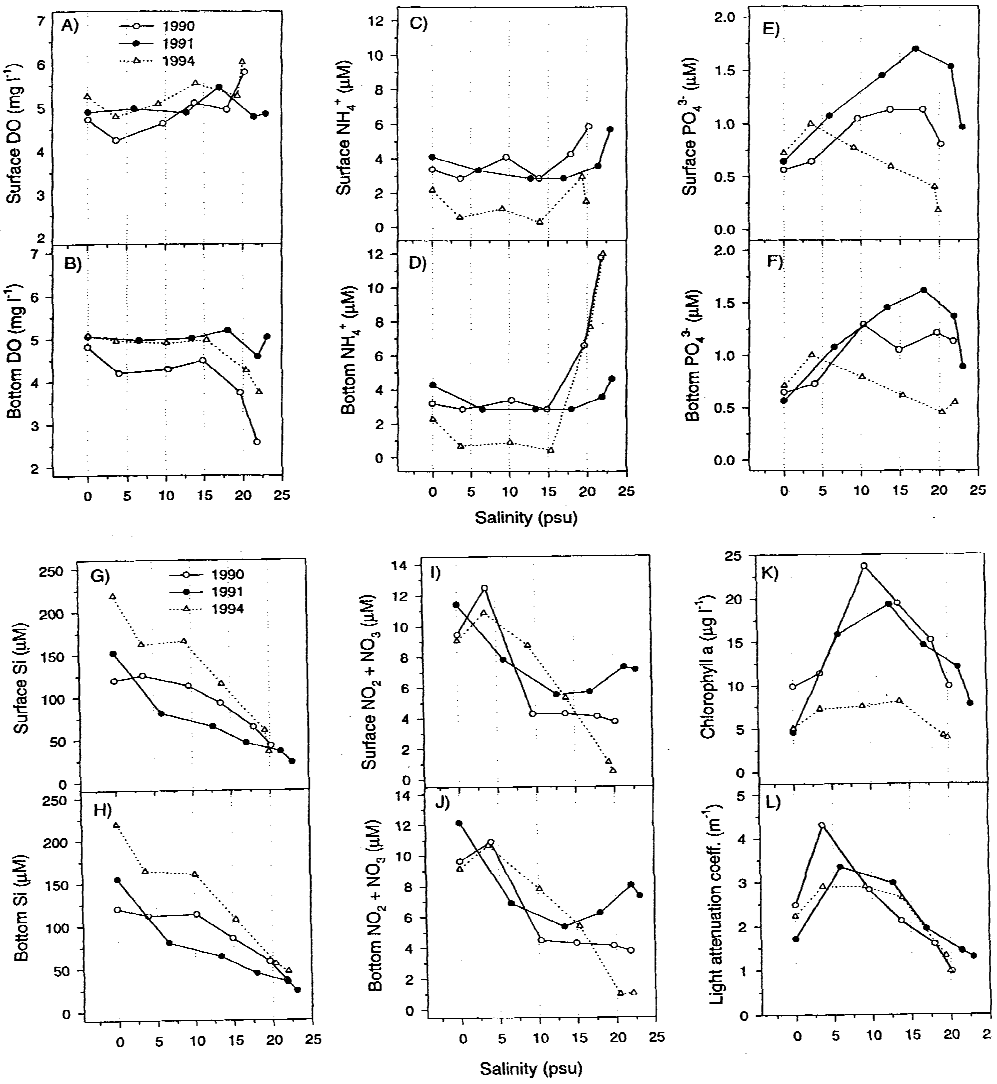
York River



The Environmental Protection Agency Chesapeake Bay Monitoring stations in the York River estuary.

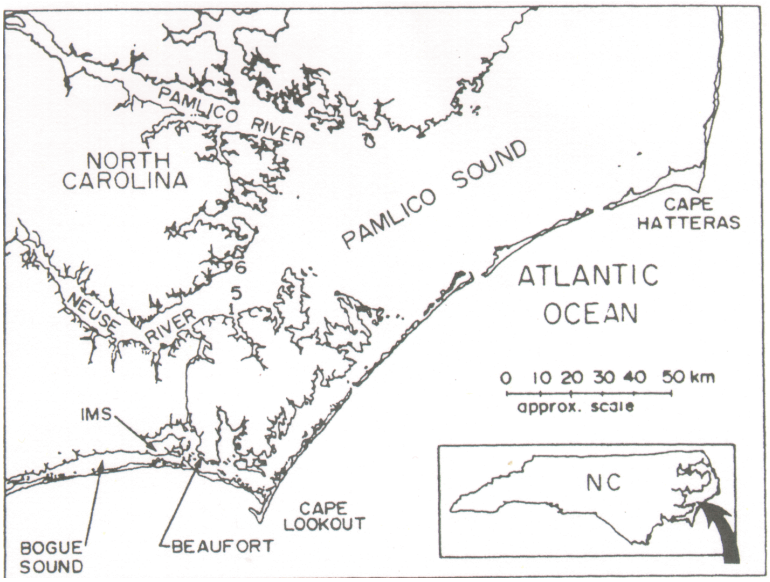


Seasonal distributions of chlorophyll *a* and primary production in the York River system; monthly means and standard errors were calculated from the 10 years data (1985-1994) for chlorophyll *a* and from 7 years data (1988-1994) for primary production. Dashed line at 10 µg 11^{-1} indicates our criterion for algal blooms and primary production shown in Fig 3F was measured at WE4.2.

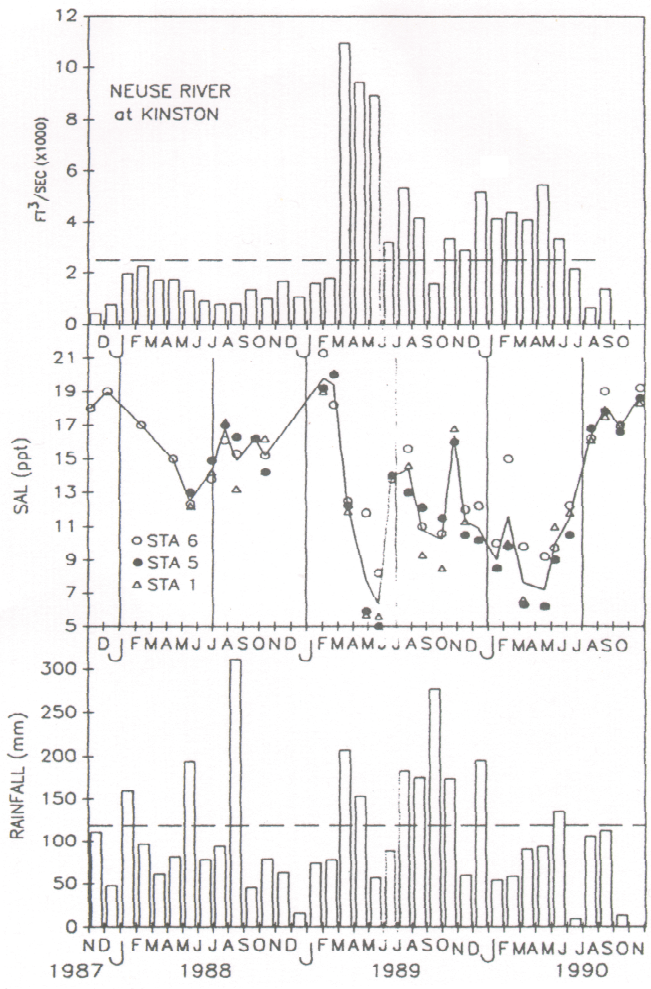


Salinity dilution curves of DO, ammonium, orthophosphate, silicate, nitrite + nitrate, chlorophyll a and light attenuation coefficient in the water column of the York River system for low (1991), mean (1990) and high (1994)flow years during the summer-fall period (June through October).

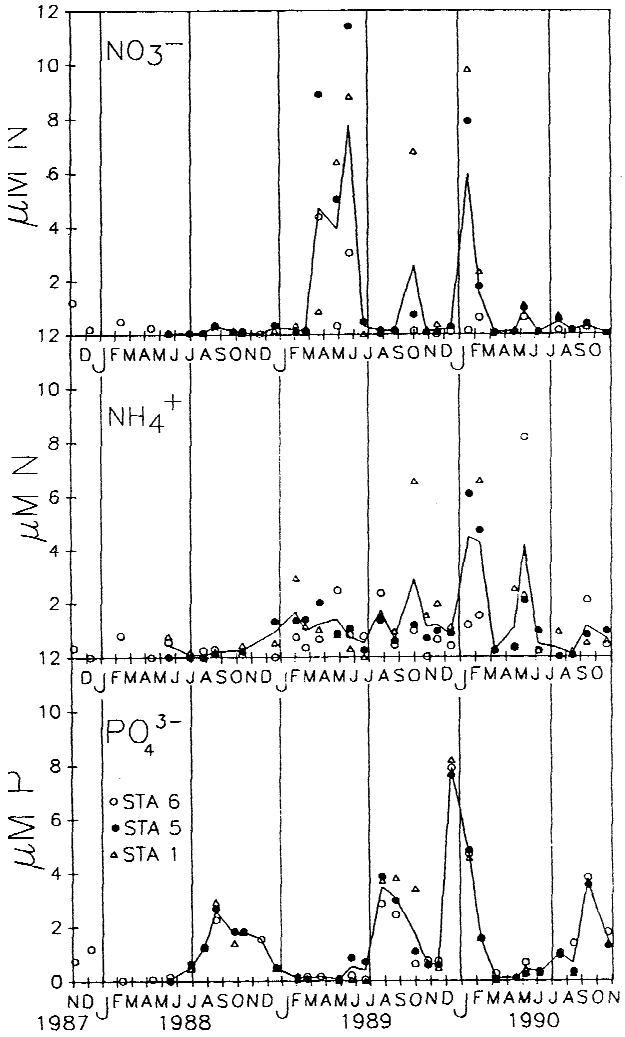
Neuse River Estuary, NC



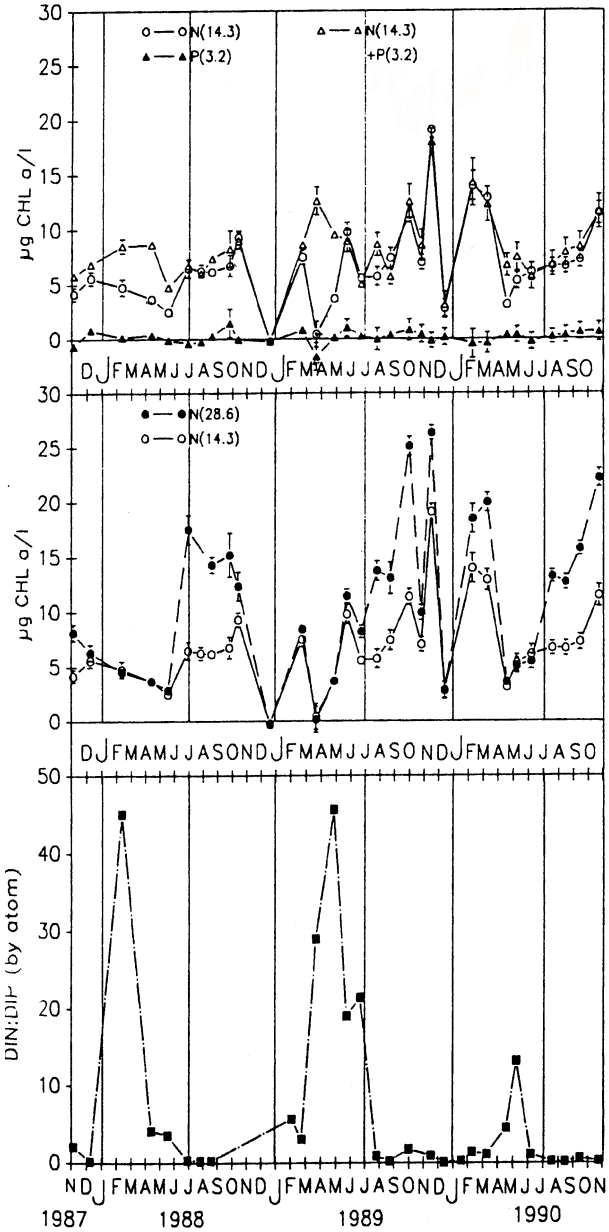
Sampling locations (Stns 1, 5, and 6) in the lower Neuse River Estuary, North Carolina, USA.



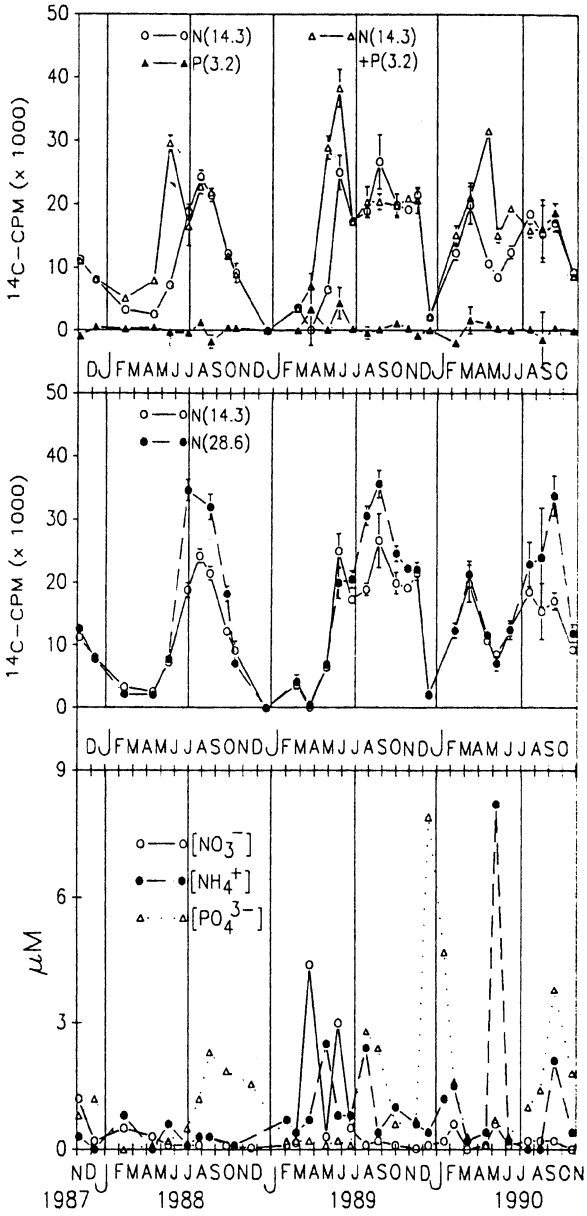
Neuse River mean monthly flows (× 1000 $ft^3 s^{-1}$ or × 28.3 $m^{-3} s^{-1}$), at the US Geological Survey gauging station in Kinston North Carolina. Dashed line represents 60 yr average flow (J.D. Bales, US Dept of Interior, Geological Survey, Water Resources Division, Raleigh, North Carolina). (Middle) Surface measurements of salinity at Stns 1, 5, and 6 (see Fig. 1). Continuous line represents means of stations measure. (Bottom) Monthly rainfall totals at the Institute of Marine Sciences, Morehead City, North Carolina. Dashed line represents average monthly precipitation for the southern section of the Albermarle-Pamilico estuarine system area (118.5 mm mo^{-1}) (H. Porter, University of North Carolina Institute of Marine Sciences, Morehead City).



Nitrate, ammonium, and phosphate concentrations in surface waters at Stns 1, 5, and 6 (see Fig. 1). Continuous line represents means among stations.

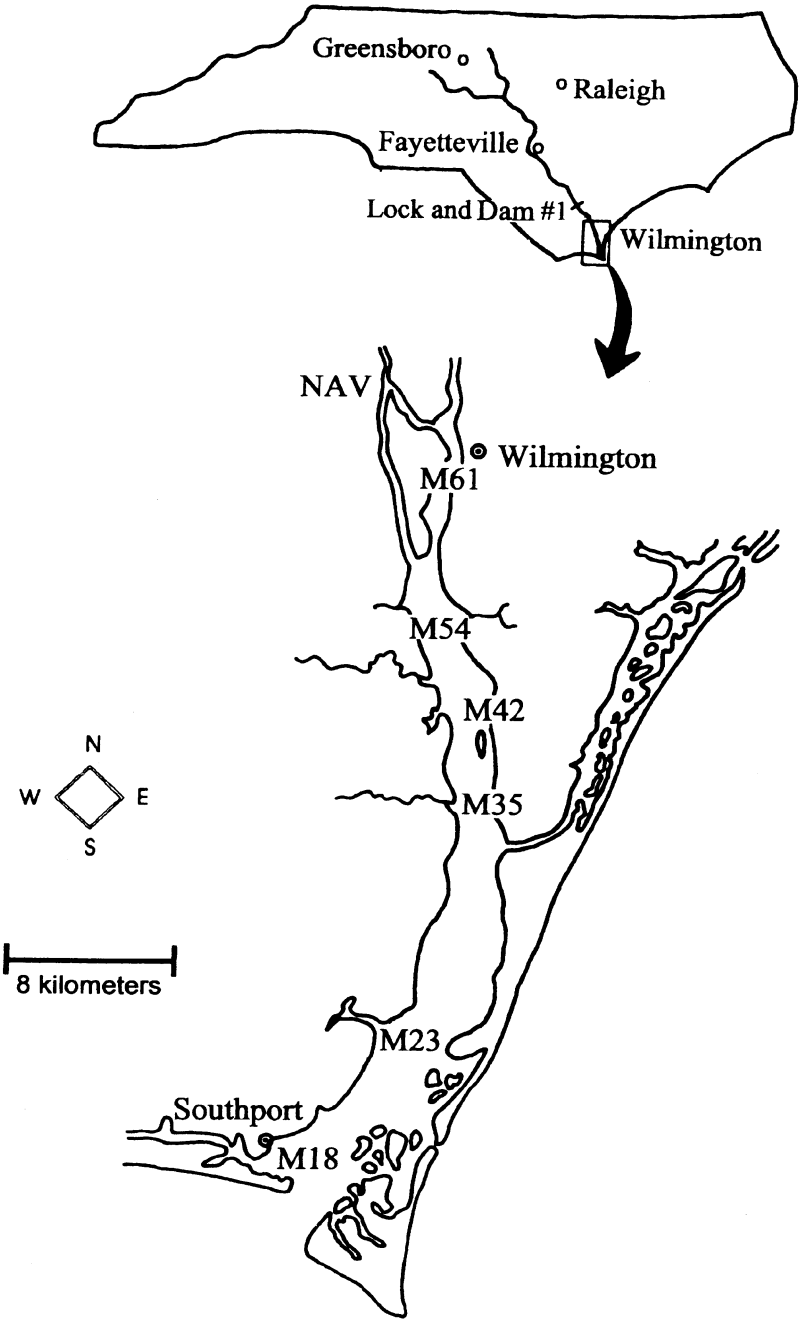


(Top and middle) Chlorophyll *a* concentration of selected nutrient addition treatments minus controls, averaged over the 4 d of each bioassay. N(14.3) and N(28.6) respectively indicate addition of 14.3 and 28.6 µm NO_3- P(3.2) indicates addition of 3.2 µm PO_4^{3-}. Error bars not visible are smaller than symbol. (Bottom) Dissolved inorganic nitrogen: dissolved inorganic phophorus (DIN:DIP) ratio (by atoms). No error bars plotted.

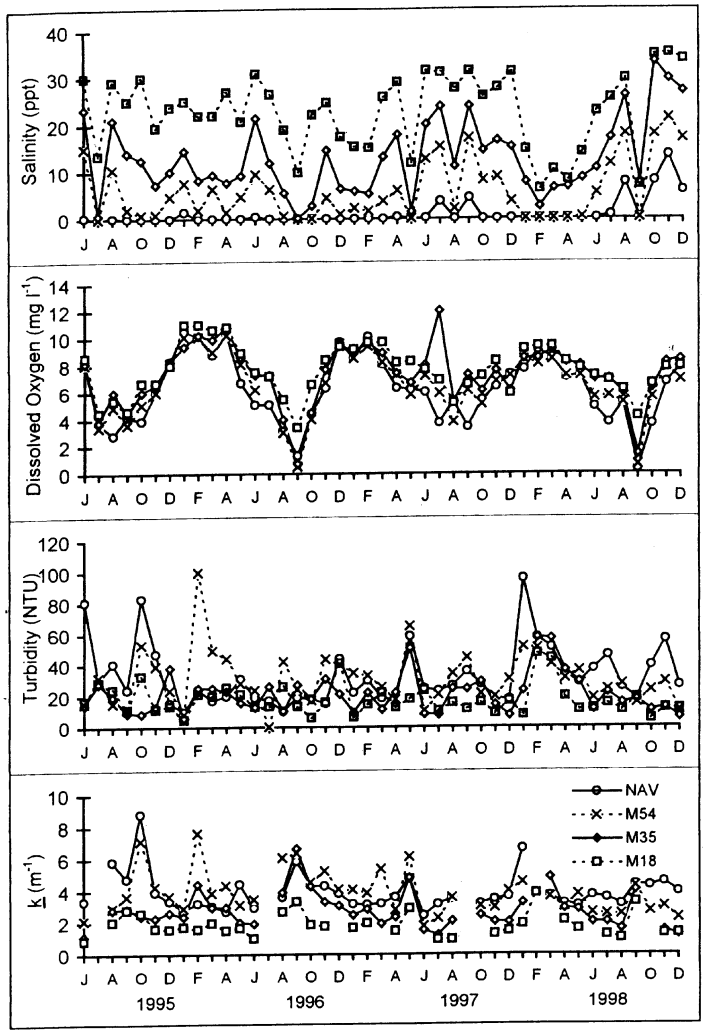


(Top and middle) ^{14}C assimilation of selected nutrient addition treatments minus xontrols, averaged over the 4 d of each bioassay. Symbols as in Fig. 4 (Bottom Nitrate, ammonium, and phosphate concentrations in surface waters at Stn 6 (see Fig. 1). Data are compiled from Fig.3 and presented here for comparative puposes.

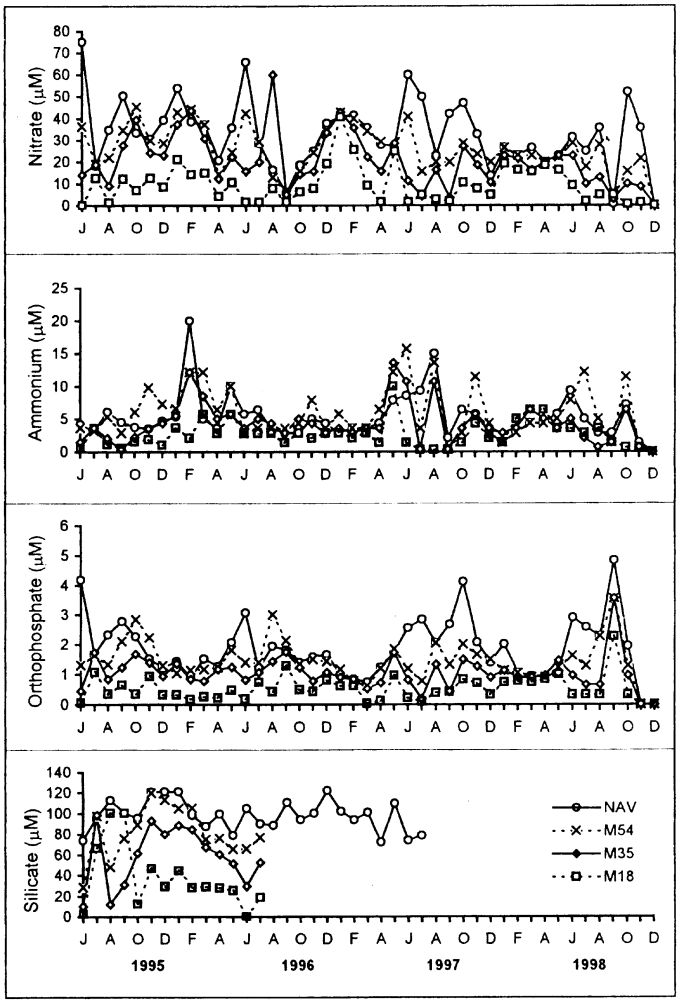
Cape Fear River Estuary



Sampling stations along the Cape Fear River Estuary, North Carolina, United States. The lower estuary is centered in 33°56′N, 77°58′W.



Physical parameters for selected stations in the Caper Fear River Estuary, June 1995-November 1998.



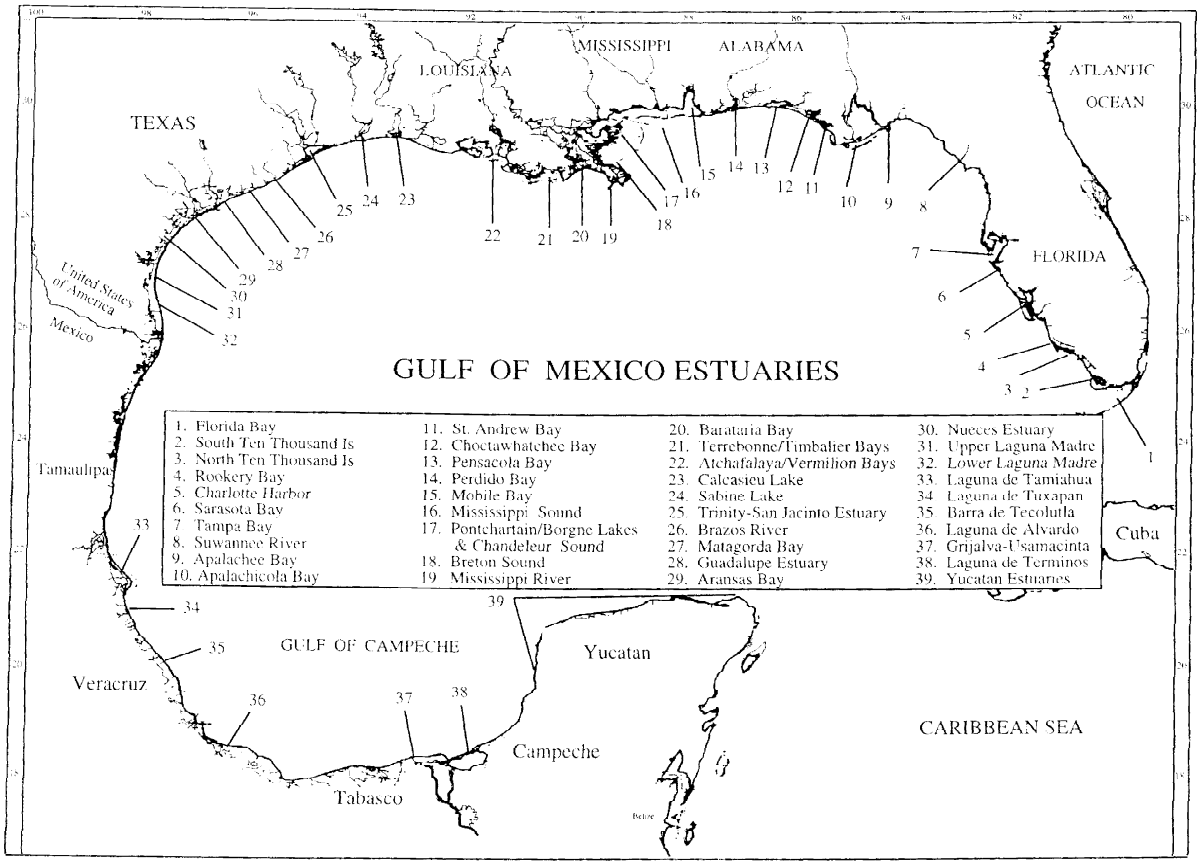
Inorganic nutrient concentrations for selected stations in the Cape Fear River Estuary, June1995- November 1998.

Coastal Georgia

Nutrient exchange (μg-atom m^{-2} d^{-1}) across the sediment/water interface and initial nutrient concentrations (μg-atom 1^{-1}) in the overlying water of the nearshore environment. Values given as release (+) or uptake (-) of the nutrient by the sediment.

Constituent	Initial Concentration μM
O_2	6.5
NH_4^+	1.1
$NO2^-$	0.11
$NO3^-$	0.16
DON	24.3
$PO4^{\equiv}$	1.4
DOP	0.0
Σ Inorganic nitrogen	1.26
Σ N	25.56
Σ Inorganic phosphorus	1.4
Σ P	1.4

Gulf of Mexico Estuaries



Map showing the distribution of estuaries in the Gulf of Mexico.

Site	Area (km^2)	Volume (10^6 m^3)	Mean Depth (m)	Maximum Length (km)	Maximum Width (km)	
Florida Bay, FL	1800	3200	2.0	70.0	40.0	Carbonate system low freshwater input
Tampa Bay, FL	896	3490	3.9	61.1	16.1	Marine dominated estuary
Apalachicola Bay, FL	593	1600	2.7	12.9	33.8	River dominated with micro-tides
Mobile Bay, AL	1060	3200	3.0	48.5	40.0	River dominated with seasonal coastal plume
Fourleague Bay, LA	56	72.8	1.3	16.0	3.5	Shallow, wetland dominated salinity variable usually low.
Nueces River Estuary, TX	538	1290	2.4	28.2	12.9	Event driven estuary, low river flows
Celestun Lagoon, Mexico	28	33	1.2	20.7	2.1	
Chelum Laggon, Mexico	13.6	16.3	1.0	14.7	1.8	Freshwater spring-fed lagoons.
Dzilam Lagoon, Mexico	9.4	11.2	0.8	12.9	1.6	
Rio Lagartos Lagoon, Mexico	96	76.8	0.8	80.0	1.5	

Table 5-1. Physical Characteristics of Gulf Estuaries Examined in Case Studies.

Site	Salinity (g liter^{-1})	NO_3 (μM)	NH_4 (μM)	PO_4 (μM)	SiO_2 (μM)
Florida Bay					
Eastern Region	29 (0.2–45)	0.62 (0.01–10.0)	3.19 (0.03–82.1)	0.03 (0.01–0.51)	16.0 (0.18–122)
Central Region	33 (9–63)	0.25 (0.01–5.70)	5.31 (0.01–120)	0.04 (0.01–0.84)	65.6 (0.06–109)
Western Region	35 (25–51)	0.12 (0.01–7.25)	0.12 (0.01–7.25)	0.03 (0.01–0.39)	18.6 (0.13–57.1)
Tampa Bay	— (20–35)	—	—	—	—
Apalachicola Bay	16.6 (0–37.3)	7.6 (1–35.7)	1.4 (0.1–7.1)	0.16 (0.1–0.62)	51.8 (3.0–136)
Mobile Bay					
Upper Bay	5.2 (0–19)	6.6 (0–40)	3.2 (0–17)	0.58 (0.05–1.4)	02.1 (13–131)
Mid Bay	9.1 (0–23)	4.1 (0–19)	2.4 (0–13)	0.46 (0.05–1.7)	59.7 (8–110)
Lower Bay	15.3 (0–32)	3.3 (0–18)	1.9 (0–12)	0.38 (0.05–1.6)	40.5 (2–104)
Fourleague Bay	—	42	2.5	0.8	—
Nueces River Estuary					
Nueces Bay	18.8 (3–30)	4.6 (0.5–23)			
Corpus Christi Bay	32.1 (28.6–37.9)	3.2 (1.5–11.3)	4.63 (0.5–19)	1.99 (0.6–4.6)	38.2 (10.5–60.8)
Celestun	25 (5–37)	4.82 (0.9–1.5)	7.82 (1–90)	0.82 (0.02–7.2)	54.4 (5–220)
Chelem	36 (27–43)	1.89 (1–6)	7.31 (1–38)	0.41 (0.1–6)	36.8 (4–50)
Dzilam	31 (30–37)	7.07 (1–10)	2.5 (1–15)	1.45 (0.2–8.1)	163 (12–210)
Rio Lagartos	57 (20–100)	0.7 (0.2–5)	8.5 (2–21)	1.55 (0.3–11)	24.7 (5–75)

Annual Mean and Range of Salinity and Nutrient Concentrations for Gulf Estuaries Examined in the Case Studies.

Site	Chlorophyll (μg liter^{-1})	Volume (mg C liter^{-1} d^{-1})	Primary Production Area (mg C m^{-2} d^{-1})	Annual (gC m^{-2} yr^{-1})
Florida Bay				
Eastern Region	0.76 (0.04–11.3)	—	—	75
Central Region	2.04 (0.21–11.6)	—	—	400
Western Region	1.83 (0.23–11.6)	—	—	250
Tampa Bay	7.5 (0–45)	—	—	—
Apalachicola Bay	5.6 (0–37.6)	21.4 (0.2–137.1)	771 (96–1812)	240 (188–300)
Mobile Bay	—	—	—	242 (194–325)
Upper Bay	6.5 (0.2–41)	—	642	—
Mid Bay	8.0 (0.2–55)	—	683	—
Lower Bay	5.5 (0.2–20)	—	661	—
Fourleague Bay	—	—	—	—
Nueces River Estuary	—	—	—	370 (270–400)
Nueces Bay	21.92	2.2 (0.2–7)	—	—
Corpus Christi Bay	8.4 (5.3–11.2)	1.2 (0.1–6)	—	—
Celestun	5.8 (0.5–28.5)	1.2 (0.21–2.1)	1440 (300–2520)	525 (109–919)
Chelem	2.8 (1.4–9)	0.42 (0.3–0.55)	420 (300–500)	153 (109–182)
Dzilam	2.7 (2–4)	0.53 (0.057–0.922)	420 (40–730)	153 (14–266)
Rio Lagartos	4.9 (2–10)	0.74 (0.054–0.875)	540 (40–700)	215 (14–255)

Annual mean and range of Chlorophyll-a Primary Production of Gulf Estuaries Examined in the Case Studies.

Galveston Bay

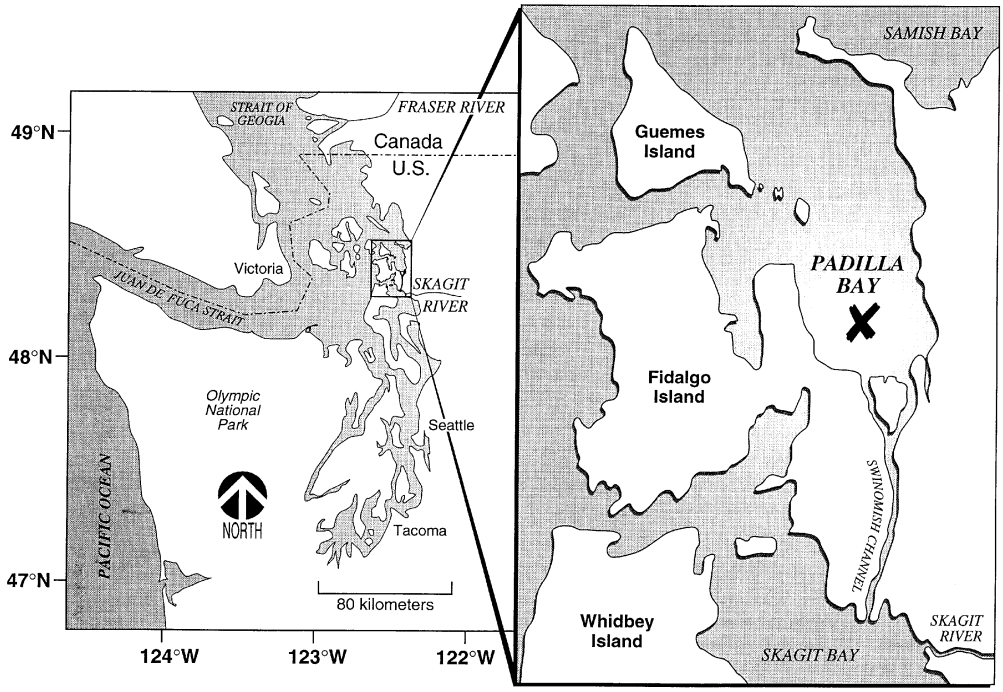
Parameter	*Trinity Bay (St.2422.02) (n = 35)*	*Smith Point/Eagle Point (St.2439.025) (n = 104)*	*Morgan's Point (St.2421.0075) (n = 57)*	*East Bay (St.2423.01) (n = 34)*	*West Bay (St.2424.01) (n = 87)*
Ortho-phosphate (mg P l^{-1})	0.21 ± 0.001	0.22 ± 0.01	0.42 ± 0.02	0.07 ± 0.008	0.07 ± 0.007
Total phosphate (mg P l^{-1})	0.26 ± 0.02	0.27 ± 0.01	0.51 ± 0.02	0.105 ± 0.013	0.10 ± 0.009
Nitrate (mg N l^{-1})	0.10 ± 0.025	0.08 ± 0.01	0.43 ± 0.05	0.03 ± 0.007	0.04 ± 0.01
Ammonia (mg N l^{-1})	0.06 ± 0.01	0.08 ± 0.01	0.20 ± 0.02	0.08 ± 0.02	0.05 ± 0.01
Nitrate (mg N l^{-1})	—	0.035 ± 0.01	0.13 ± 0.02	—	—
Total Kjeldahl nitrogen (mg N l^{-1})	—	1.4 ± 0.06	—	—	—
Salinity (o%)	9.1 ± 1.2	17.3 ± 0.6	15.3 ± 1.1	15.9 ± 0.8	24.8 ± 0.8
Total suspended solids (mg l^{-1})[a]	15 ± 1.7	20 ± 1.5	27.7 ± 5.7	—	—
Total organic carbon (mg C l^{-1})	—	7.4 ± 0.5	4.4 ± 0.7	—	—
Chlorophyll-*a* (μg l^{-1})	3.8 ± 0.9	8 ± 1	14.6 ± 2.4	5.0 ± 1.4	2.9 ± 0.5

[a] Called 'total residue concentration' in TWC database. The arithmetic averages are for illustrative purposes only, and do not claim true statistical meaning; Morgan's Point has higher salinity due to the fast transport of seawater in the ship channel, and lower freshwater input from the San Jacinto River.

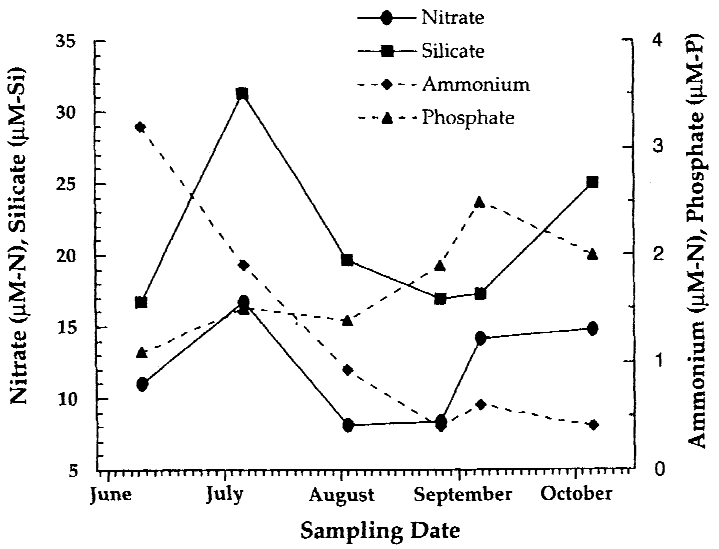
Average Concentrations of Nutrients and Other Chemical Parameters in Galveston Bay, Calculated from the TWC Database (± 1σ).

Puget Sound

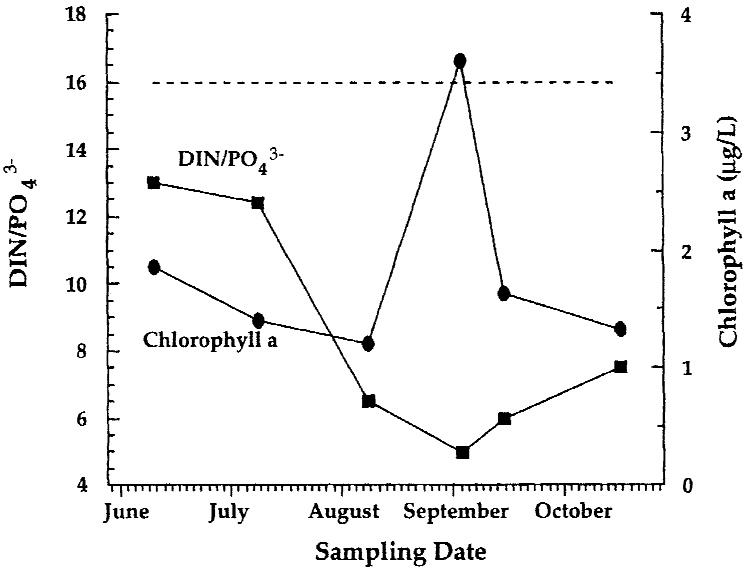
Padilla Bay



Map showing location of Padilla Bay in relation to Puget Sound (left) and the study site (X) in Padilla Bay.



Dissolved inorganic nutrient concentration in surface water at the study site from June to October 1992.



DIN:PO_4^{3-} ratios and chlorophyll a concentrations in surface water at the study site from June to October 1992. DIN is $NO_3^- + NO_2^- + NH_4^+$. PO_4^{3-} is soluble reactive phosphate. The dotted line represents the Redfield ratio of 16:1.